Overview of selected light-weight mirror development programs at GSFC

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Outline

- Light-weight technology demonstration mirror program with Kodak
- Lightweight cryostable mirror development

Lightweight Technology Demonstration Mirror Program

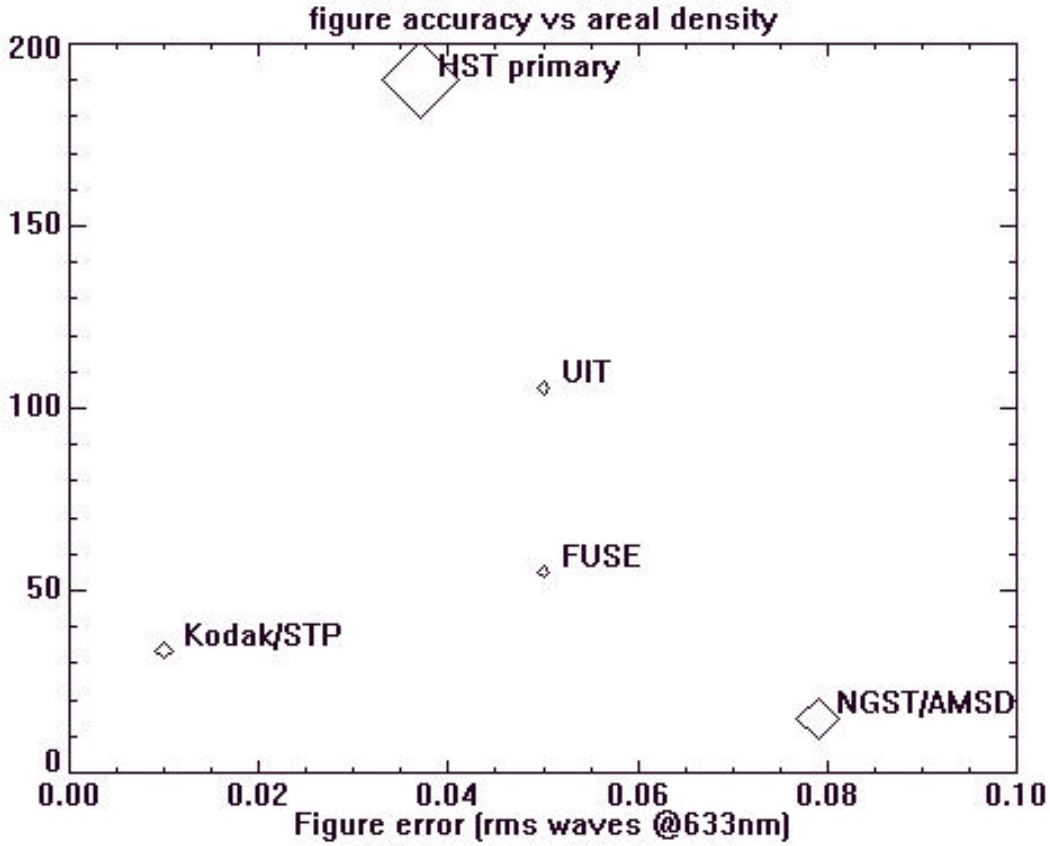
Objective:

- Produce a lightweight, precision, low scatter mirror that advances the state-of-the-art in lightweight, precision mirror technology for far and extreme ultraviolet applications.
- Long term goal is diffraction limited performance below 100 nm.

Specifications

- Surface Shape: Parabola, axi-symmetric
- Material: ULE
- Weight: 82% light-weighted, mass 4.6 kg
- Outer Diameter: 0.559 m
- Inner Diameter: 0.14 m
- Clear Aperture: 0.533 m OD, 0.165 m ID
- Focal Length: 0.65 m, f/1.21
- Surface Figure:
  - global: 0.01 λ rms at 632.8
  - mid frequency: 2.5 nm rms (goal < 1.0 nm), spatial periods of 1 mm - 10 mm
  - microroughness: 1 nm rms (goal), spatial periods of 1 μm - 1.0 mm

Figure Accuracy vs Areal Density for Selected Lightweight Mirrors



Mirror Design

Stiff sandwich type construction

- front and back face sheets
- lightweight waterjet cut core with hexagonal cell structure
- core and face sheets fused together into a monolithic all-glass structure

Design Parameters

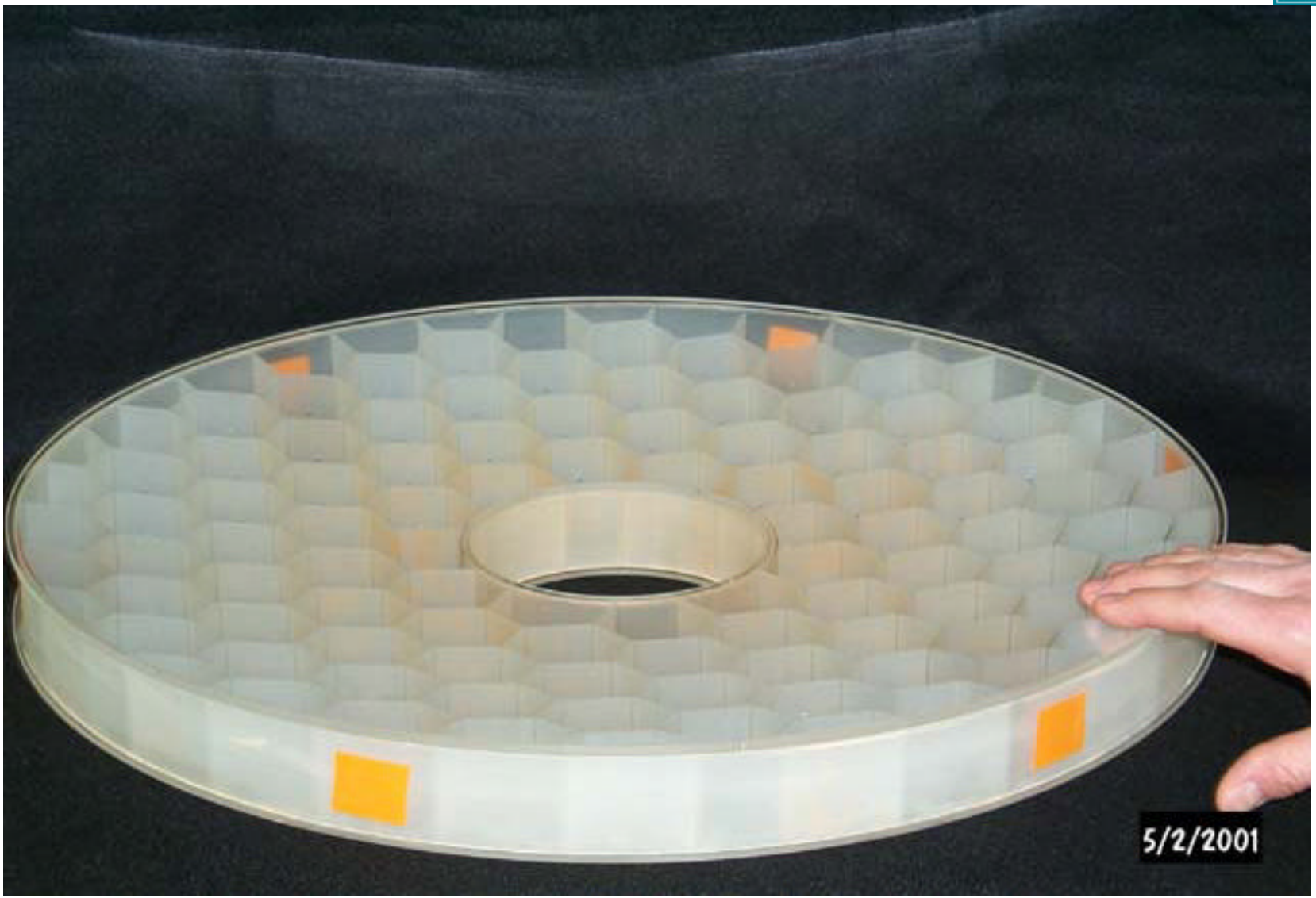
- Outer diameter: 0.559 m
- Inner diameter: 0. 14 m
- Edge thickness: 48 mm
- Faceplate thickness: 3.5 mm
- Backplate thickness: 2.5 mm
- Cell wall thickness: 1.27 mm
- Cell inscribed circle diameter: 49 mm
- Nominal radius of curvature: 1.29 m
- Weight: 4.54 kg
- Areal density: 19.76 kg/m2
- % Lightweighting: 81.52 %
- Natural frequency (3 point support): 1010 Hz

Mirror Mount Design

- Mirror mount consists of three bipod/mount pad sub-assemblies and a plate interface
  - three invar pads bonded to the back of the mirror
  - each pad connects to two flextures
  - the flexures clamped to lower pads that attach to the plate interface
- Kodak has used this type of bipod mount successfully on other space flight experiments

Status

- Mirror and mount design completed
- Mirror blank fabricated, grinding and initial polishing completed
- Mount fabrication, final polishing and testing scheduled to be completed Oct. 2001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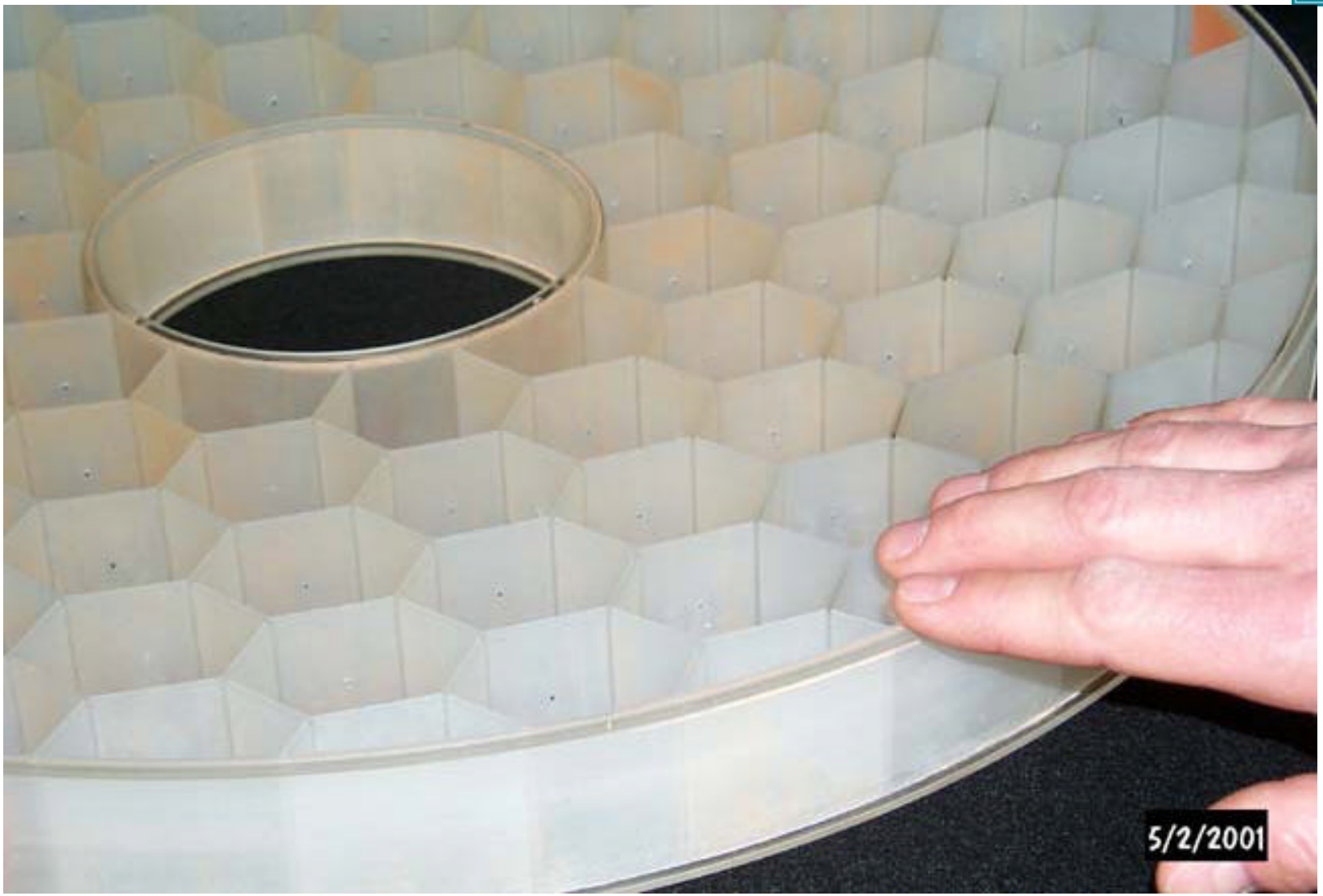
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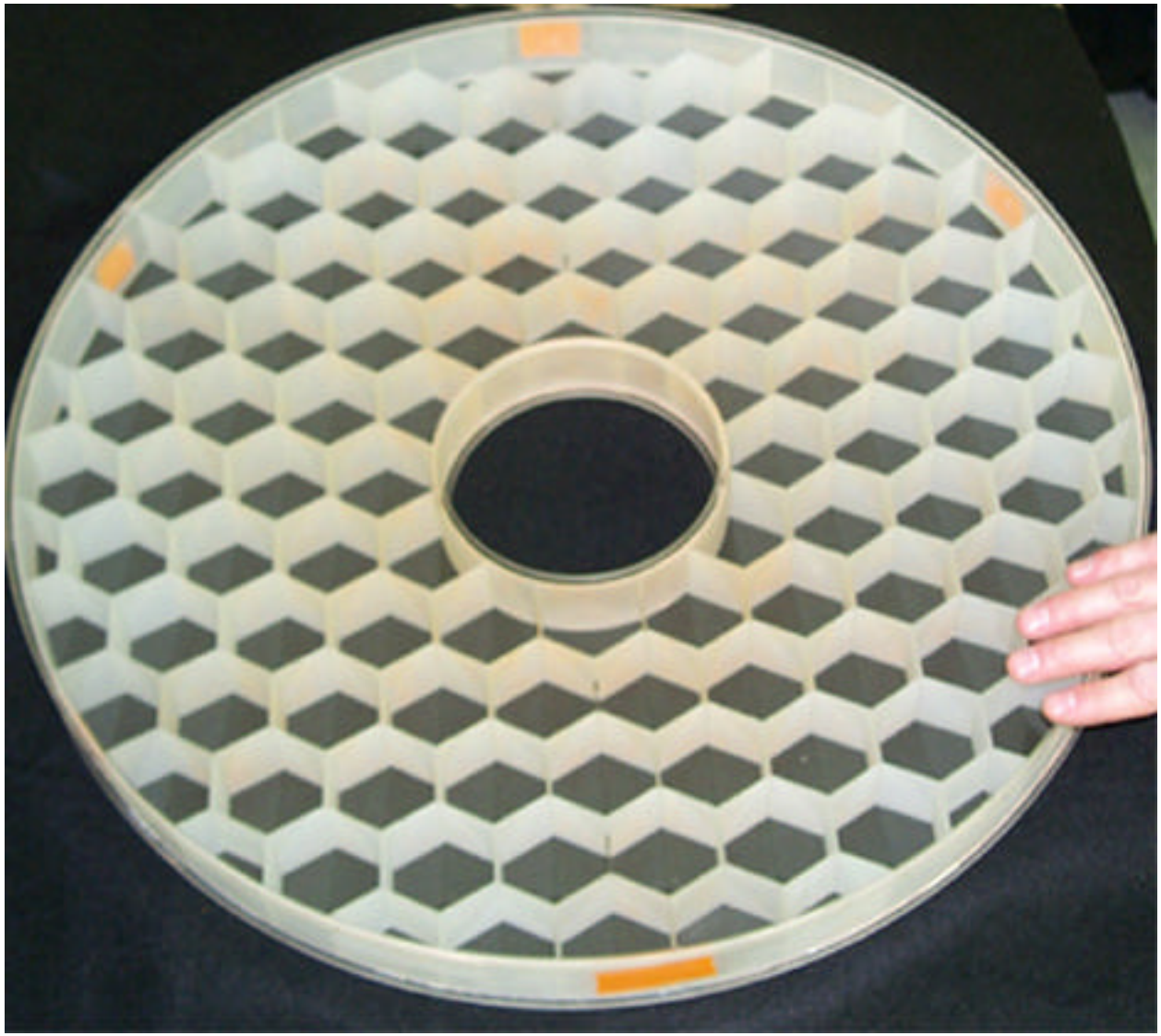

Applications

- Jupiter Magnetospheric Explorer (JMEX)
- MIDEX class missions
  - Kronos
  - Far Ultraviolet Imaging Mission
- Sun Earth Connection (SEC) Science Missions
- Space Ultraviolet Optical Telescope (SUVO)

Future Plans for the Mirror

- Coat the mirror with a coating optimized for EUV/FUV
- Test for imaging and scatter performance in the EUV/FUV
- Fly the mirror on a solar physics experiment

DGEF stainless steel vacuum cover being removed for preparation for UV test setup